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Microstructure, magnetization and magnetotransport of $RuSr_2GdCu_2O_{8-\delta}$

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A sample of $RuSr_2GdCu_2O_{8-\delta}$ (Ru-1212) is synthesised through a solid-state reaction route. Ru-1212 crystallises in tetragonal $P4/mmm$ structure with $a = b = 3.8337$ Åand $c = 11.4926$ Å. The magnetization $vs.$ temperature (M-T) behaviour of the sample measured in 5 Oe field, indicates a clear zero-field-cooled (ZFC) and field-cooled (FC) branching at around 140 K with a cusp at 135 K and a diamagnetic transition around 20 K in the ZFC part. Isothermal magnetization moments showed a non-linear contribution from the ferromagnetic component at low T below 50 K. The resistance $vs.$ temperature (ρ-T) behaviour of the compound in zero and 7 Tesla fields confirmed superconductivity at around 20 K. Ru-1212 shows systematic changes in magnetoresistance (MR). MR is positive above the magnetic ordering temperature. Below the magnetic ordering temperature MR displays a positive peak at low fields and becomes negative at higher fields. Electron diffraction pattern of the compound showed two superstructures: one weak spot at the centre of the $a - b$ rectangle, due to RuO_6 octahedra tilt angle and the other along the b direction. There is a possibility that either Ru/Cu or vacancy ordering of $2b$ periodicity is taking place along the b direction. We would like to mention that we also get the b-direction clean $a - b$ plane with only RuO_6 tilt angle superstructure.

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